1.0 OBJECTIVES

This is an interagency consultation pursuant to Section 7(a)(2) of the Endangered Species Act (ESA) and implementing regulations found at 50 CFR Part 402. It consists of three actions.

- The Federal agencies that operate, or market power from, the Federal Columbia River Power System (FCRPS), namely the Bonneville Power Administration (BPA), the U.S. Army Corps of Engineers (Corps), and the U.S. Bureau of Reclamation (BOR) (collectively the "Action Agencies"), reinitiated consultation with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) to consider the effects of actions related to FCRPS configuration, operations, and maintenance on species listed as threatened or endangered under the ESA.

- BOR has also initiated consultation on the continued operation and maintenance of its 31 projects in the Columbia River basin (Table 1-1). Two of these projects, the Columbia Basin Project and the Hungry Horse Project, include facilities that are also part of the FCRPS. Several of the remaining 29 BOR-owned projects in the basin include power plants and/or provide flood control benefits, but these power plants (and their associated dams and reservoirs) are not operated or coordinated as part of the FCRPS, nor do these project facilities provide system flood control. All 31 BOR projects are authorized to provide water for irrigated agriculture and all except the Hungry Horse Project do so at this time. While the configuration, operation, and maintenance of the FCRPS and the operation and maintenance of BOR's 31 projects are separate agency actions, they are similar in that they both have hydrologic effects on the flows in the mainstems of the Columbia and Snake rivers. However, this Biological Opinion does not attempt to apportion the relative contribution of the FCRPS and BOR projects to the current status of the ESUs.

- NMFS is also consulting internally on its issuance of a Section 10 permit for the Corps' Juvenile Fish Transportation Program. The FCRPS operation necessarily includes the Juvenile Fish Transportation Program the Corps operates, which requires an enhancement permit issued by NMFS pursuant to ESA Section 10(a)(1)(A).

With respect to the FCRPS projects, this Biological Opinion considers the effects of the existing configuration, continued operation, and maintenance of the 14 sets of dams, powerhouses, and associated reservoirs known collectively as the FCRPS and operated as a coordinated system for the purposes of power production and flood control on behalf of the Federal government. The facilities that constitute the FCRPS are Dworshak, Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams, powerplants, and reservoirs in the Snake River basin; Albeni Falls, Hungry Horse, Libby, Grand Coulee, and Banks Lake (features of the Columbia Basin Project), as well as Chief Joseph dams, powerplants, and reservoirs in the upper Columbia River basin; and McNary, John Day, The Dalles, and Bonneville dams, powerplants, and reservoirs in the lower Columbia River basin. Some of these dams and reservoirs are also operated for other

Table 1-1. BOR Irrigation Projects in the Columbia River Basin

Project	Location	Subbasin or Stream
Upper Columbia River (Upstream of Snake River Confluence)		
Hungry Horse	Western Montana, north of Flathead Lake	South Fork Flat Head River
Bitter Root	Western Montana, south of Missoula	Bitterroot River
Missoula Valley	Western Montana, north of Missoula	Clark Fork River
Frenchtown	Western Montana, north of Missoula	Clark Fork River
Dalton Gardens	North Idaho, north of Coeur d'Alene	Spokane (Hayden Lake)
Avondale	North Idaho, north of Coeur d'Alene	Spokane (ground water)
Rathdrum Prairie	North Idaho, northwest of Coeur d'Alene	Spokane (ground water)
Spokane Valley	Eastern Washington, east of Spokane	Spokane (ground water)
Columbia Basin	Central Washington	Columbia River
Chief Joseph Dam	North-central Washington, from Canadian border to Wenatchee	Okanogan and Columbia rivers
Okanogan	North-central Washington, near Okanogan	Okanogan River
Yakima	Central Washington, near Yakima	Yakima River
Lower Columbia (Downstream of the Snake River Confluence)		
Umatilla	Northeast Oregon	Umatilla and Columbia rivers
Arnold	Central Oregon, south of Bend	Deschutes River
Crescent Lake Dam	Central Oregon west of Bend	Deschutes River
Crooked River	Central Oregon, north of Bend	Crooked River
Deschutes	Central Oregon, north of Bend	Deschutes River
Wapinitia	North-central Oregon, south of The Dalles	Deschutes River
The Dalles	North-central Oregon, near The Dalles	Columbia River
Tualatin	Northwest Oregon, west of Portland	Tualatin River (Willamette River)
Snake River		
Minidoka	Southern Idaho and western Wyoming from Twin Falls Idaho to Jackson Lake, Wyoming	Snake River
Palisades	Eastern Idaho, on Wyoming border	Snake River
Michaud Flats	Southern Idaho, near Pocatello	Snake River
Little Wood River	South-central Idaho, north of Twin Falls	Little Wood River
Boise	Southwest Idaho, near Boise	Boise and Payette rivers
Mann Creek	Southwest Idaho, northwest of Boise	Weiser River
Owyhee	Eastern Oregon and southwest Idaho, near Ontario Oregon	Owyhee and Snake rivers
Vale	Eastern Oregon, west of Ontario	Malheur River
Burnt River	Eastern Oregon, south of Baker City	Burnt River
Baker	Eastern Oregon, near Baker City	Powder River
Lewiston Orchards	West-central Idaho, near Lewiston	Clearwater River

purposes as authorized by Congress (e.g., navigation, irrigation, fish and wildlife, and recreation). These operations are inseparable from those for power generation and flood control. They are included in the scope of this consultation, except where activities are separate Federal actions under other authorities (e.g., CWA section 404).

With respect to the 31 BOR projects, formal consultation on the full scope of these proposed operations is being accomplished as follows:

1. This Biological Opinion considers the aggregate effects of all 31 BOR projects on streamflows (these effects result from reservoir storage and releases, diversions and withdrawals, consumptive uses, and return flows) It also considers the effects of the use of some of these projects and other sources to provide in-stream flow in the Columbia River downstream from Chief Joseph Dam and the Snake River downstream from Hells Canyon Dam. Effects considered include the frequency of attainment of the flow objectives established in the 1995 FCRPS Biological Opinion and 1998 Supplement FCRPS Biological Opinion.

2. This Biological Opinion also considers all of the known operational effects of the BOR projects located upstream from Chief Joseph Dam and upstream from Hells Canyon Dam. The only known effects of these projects on listed salmon and steelhead result from the cumulative hydrologic effects of their operations on streamflows in the Columbia River downstream from Chief Joseph Dam and in the Snake River downstream from Hells Canyon Dam.

3. For those BOR projects located downstream from Chief Joseph Dam or Hells Canyon Dam in the Columbia River Basin, except for the Columbia Basin Project, the BOR has already prepared BAs, or, as appropriate, is preparing supplemental BAs to address any additional effects of such projects, such as effects on tributary habitat, tributary water quality, or direct effects on salmon survival (impingement, entrainment in diversions, false attraction to return flows), through project-specific, supplemental consultations. Because mainstem flows are addressed in this biological opinion, these supplemental consultations will address effects of mainstem flows only to the extent to which consultation reveals additional effects on the mainstem flow regime which were not considered in this FCRPS Biological Opinion.

4. The Columbia Basin Project, features of which are located both upstream and downstream from Chief Joseph Dam, diverts and returns water from and to the mainstem Columbia River above McNary Dam (with all diversions from the Columbia River occurring above Chief Joseph Dam, but with all return flows occurring below Chief Joseph Dam). Its storage and diversion operations are integral to the operation of Grand Coulee Dam. All of the project's effects on listed salmon and steelhead occur in the mainstem. For these reasons, BOR initiated consultation specifically on the operation and maintenance of all the Federally owned lands and facilities of the project (whether such operation and maintenance is performed by BOR or by others pursuant to

agreements with BOR). This FCRPS Biological Opinion, therefore, considers all of the known operational effects of the Columbia Basin Project, not just its contribution to cumulative hydrologic impacts on streamflows in the Columbia River, even though some of the project's features are located downstream from Chief Joseph Dam in the Columbia River basin.

This consultation considers the effects of these actions on the likelihood of survival and recovery of 12 species of Columbia Basin Project salmonids:

- Snake River (SR) spring/summer chinook salmon (*Oncorhynchus tshawytscha*; listed as threatened on April 22, 1992 [57 FR 14653])
- SR fall chinook salmon (*O. tshawytscha*; listed as threatened on April 22, 1992 [57 FR 14653])
- Upper Columbia River (UCR) spring chinook salmon (*O. tshawytscha*; listed as endangered on March 24, 1999 [64 FR 14308])
- Upper Willamette River (UWR) chinook salmon (*O. tshawytscha*; listed as threatened on March 24, 1999 [64 FR 14308])
- Lower Columbia River (LCR) chinook salmon (*O. tshawytscha*; listed as threatened on March 24, 1999 [64 FR 14308])
- Snake River (SR) steelhead (*O. mykiss*; listed as threatened on August 18, 1997 ([62 FR 43937])
- Upper Columbia River (UCR) steelhead (*O. mykiss*; listed as endangered on August 18, 1997 [62 FR 43937])
- Middle Columbia River (MCR) steelhead (*O. mykiss*; listed as threatened on March 25, 1999 [64 FR 14517])
- Upper Willamette River (UWR) steelhead (*O. mykiss*; listed as threatened on March 25, 1999 [64 FR 14517])
- Lower Columbia River (LCR) steelhead (*O. mykiss*; listed as threatened on March 19, 1998 [63 FR 13347])
- Columbia River (CR) chum salmon (*O. keta*; listed as threatened on March 25, 1999 [64 FR 14508])
- Snake River (SR) sockeye salmon (*O. nerka*; listed as endangered on November 20, 1991 [56 FR 58619])

Throughout this biological opinion, NMFS uses the term Evolutionarily Significant Unit (ESU) to define anadromous salmon and steelhead populations either listed or being considered for listing under the ESA. An ESU is a population that (1) is substantially reproductively isolated from conspecific populations and (2) represents an important component of the evolutionary legacy of the species. The term ESU may include portions or combinations of more commonly used definitions of stocks within or across regions.

1.1 RELATION TO OTHER BIOLOGICAL OPINIONS

This FCRPS Biological Opinion supersedes all previous opinions NMFS has issued concerning the FCRPS. This includes the March 2, 1995, biological opinion entitled "Reinitiation of Consultation on 1994-1998 Operation of the Federal Columbia River Power System and Juvenile Transportation Program in 1995 and Future Years" and the supplemental opinions NMFS issued on May 14, 1998, December 9, 1999, and February 4, 2000. Further, NMFS and USFWS have coordinated this multispecies opinion and the draft opinion USFWS issued on the effects of hydrosystem operations on Columbia basin species within their jurisdiction, dated May 12, 2000. The two agencies intend the recommendations and requirements of these opinions to be mutually consistent. They represent the Federal biological resource agencies' recommendations of measures that are most likely to ensure the survival and recovery of all listed species and that are within the current authorities of the Action Agencies.

1.2 SECTION 10 PERMITS FOR THE JUVENILE TRANSPORTATION PROGRAM

In 1999, the Corps Walla Walla District applied to NMFS for a new Section 10 permit for the Juvenile Fish Transportation Program. As an interim measure, NMFS extended the Corps' existing Permit 895, under authority of Section 10 of the ESA and NMFS' regulations governing ESA-listed fish and wildlife permits (50 CFR parts 217 through 227), to be valid until December 31, 2000, or until replaced by the new permit. The extension of Permit 895 allows the duration of the permit to coincide with the completion of this reinitiation of ESA Section 7 consultation on the long-term management strategy for the FCRPS. Permit 895 authorizes the Corps' annual direct takes of the following listed fish: juvenile endangered SR sockeye salmon and juvenile, threatened, naturally produced, and artificially propagated SR spring/summer chinook salmon, SR fall chinook salmon, and SR steelhead. This take is authorized for the Corps' Juvenile Fish Transportation Program at four hydroelectric projects on the Snake and Columbia rivers (Lower Granite, Little Goose, Lower Monumental, and McNary dams). Permit 895 also authorizes the Corps' annual incidental takes of ESA-listed adult fish associated with fallbacks through the juvenile fish bypass systems at the four dams.

With regard to three other evolutionarily significant units (ESUs) (UCR spring chinook salmon, UCR steelhead, and MCR steelhead), NMFS has determined that any take of these species associated with the Corps' transportation activities would be incidental to operation of the juvenile bypass system under the existing requirement to suspend transportation operations at McNary Dam during the spring migration period. NMFS' estimates of incidental take for each of

these ESUs is described in the Section 10 Incidental Take Statement [ITS]. Any direct take of UCR spring chinook salmon, UCR steelhead, and MCR steelhead for the purposes of the planned transport experiment from McNary Dam will be addressed in a separate Section 10 permit.

In addition, Permit 895 does not cover direct take of the following lower Columbia River ESUs: UWR chinook salmon, UWR steelhead, LCR chinook salmon, LCR steelhead, and CR chum salmon. The juveniles from all of the spawning populations in these ESUs enter the Columbia River at points below McNary Dam. Thus, they are not subject to either direct or incidental take associated with the Corps' transportation program.

1.3 APPLICATION OF ESA SECTION 7(A)(2) STANDARDS–JEOPARDY ANALYSIS FRAMEWORK

To achieve the objectives of this Biological Opinion, NMFS uses a five-step approach for applying the ESA Section 7(a)(2) standards developed in the 1995 FCRPS Biological Opinion to Pacific salmon. The steps are as follows:

1. Define the biological requirements and current status of each listed species (Section 4).

2. Evaluate the relevance of the environmental baseline to the species' current status (Section 5).

3. Determine the effects of the proposed or continuing action on listed species (methods described in Section 6.1 and applied in Section 6.2).

4. Determine whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action, the environmental baseline and any cumulative effects, and considering measures for survival and recovery specific to other life stages (Section 8).

5. Identify reasonable and prudent alternatives to a proposed or continuing action that is likely to jeopardize the continued existence of a listed species or destroy or adversely modify its critical habitat (Section 9). This step is relevant only when the conclusion of the previously described analysis is that the proposed action would jeopardize listed species. The reasonable and prudent alternative will both have to reduce the mortality associated with the proposed action to a level that does not jeopardize the species and maintain (or restore) essential habitat features so that there is no adverse modification of designated critical habitat. An analysis to determine the sufficiency of the reasonable and prudent alternative will be based on the same considerations described above.

As discussed in the 1995 FCRPS Biological Opinion, the fourth step of the application framework called for a two-part analysis. The first part focuses upon the action area, delineated as the geographic extent of direct and indirect effects of the action (50 CFR § 402.02). The effects of the action, the effects of the environmental baseline, and the cumulative effects within

the action area are considered together relative to the action area biological requirements of the various listed species. The essential features of critical habitat guide analysis in this part.

The second part of this analysis places the action area investigation in the context of the full salmon life cycle, considering each ESU's species-level biological requirements.

> This comprehensive analysis is necessary to fully evaluate the significance of each action under consultation to the biological requirements of the listed species in all life stages. The NMFS looks beyond the particular action area for this analysis to consider measures likely to be necessary in all life stages that, in combination, would insure that the biological requirements of the listed species will be met and thereby insure its continued existence (1995 FCRPS Biological Opinion; pp. 13-14).

For the purpose of this second part of Step 4 of the ESA Section 7 framework, to assess the effects of proposed actions while listed ESUs move toward recovery, NMFS defined the degree to which species-level biological requirements must be met (NMFS 1995a [1995 FCRPS Biological Opinion]):

> At the species level, NMFS considers that the biological requirements for survival, with an adequate potential for recovery, are met when there is a high likelihood that the species' population will remain above critical escapement thresholds over a sufficiently long period of time. Additionally, the species must have a moderate to high likelihood that its population will achieve its recovery level within an adequate period of time. The particular thresholds, recovery levels, and time periods must be selected depending upon the characteristics and circumstances of each salmon species under consultation.

Pursuant to the ESA, NMFS evaluates the species-level biological requirements of a species, subspecies, or distinct population segment level. For Pacific salmonids, NMFS evaluates species-level biological requirements as they relate to ESUs. Since 1995, NMFS has developed the viable salmonid population concept as a tool to evaluate whether the species-level requirements of ESUs are being met (McElhany et al. 2000). Each salmonid ESU may contain multiple independent populations. Viable salmonid populations are independent populations that have a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over 100 years. The attributes associated with viable salmonid populations include adequate abundance, productivity (population growth rate), population spatial scale, and diversity. These attributes are influenced by survival, behavior, and experiences throughout the entire life cycle and are, therefore, distinguished from the more specific biological requirements associated with the action area (described in Section 5) and the particular action under consultation. Species-level biological requirements are influenced by *all* actions affecting the species throughout its life cycle and may be broader than the requirements of any specific independent population within the ESU. The action-area effects must be reviewed in the context of these species-level

biological requirements to evaluate the potential for survival and recovery, given the comprehensive set of human activities and environmental conditions affecting the species.

Although the 1995 narrative standard, quoted above, defined the direct measurement of species-level biological requirements in terms of abundance, this definition also implicitly addresses the productivity criterion for viable populations. Given the current low abundance levels, the population growth rate must increase to reach the critical threshold or recovery abundance levels. In the long term, the population growth rate must remain high enough to maintain a stable return rate and keep populations at acceptable abundance levels. Although application of VSP by a Technical Recovery team may in the future suggest measurements of spatial scale and diversity, this Biological Opinion considers biological requirements primarily in terms of abundance and productivity.

For ESUs with multiple populations, the spatial scale and diversity criteria for viable populations are addressed primarily by specifying the number of populations that must meet species-level biological requirements, as defined above. This is considered on an ESU-by-ESU basis. The degree to which independent populations within an ESU have been delineated, and their relation to each other, can be relevant to a Section 7 decision. Particularly important is the state of knowledge regarding the degree to which a mixture of independent populations within an ESU is required for the ESU to survive in the face of catastrophic events and long-term demographic processes and to maintain long-term evolutionary potential (McElhany et al. 2000). To the extent possible, jeopardy determinations should be based on evaluation of available information to determine if identified breeding units represent independent populations, as defined by McElhany et al. (2000). However, biological populations have not yet been defined for most ESUs. In the case of the SR spring/summer chinook ESU, NMFS determined in the 1995 Biological Opinion that the relevant measure is "at least 80% of the available 'index stocks.'" NMFS' Proposed Recovery Plan for Snake River Salmon (NMFS 1995) also described "80% of available index stocks" as the percent required to meet specified abundance levels for delisting. For all other ESUs, all currently defined populations should be maintained to ensure adequate genetic and life history diversity, as well as the spatial distribution of populations within each ESU.

Step 4 of the application framework ultimately requires that NMFS determine whether the species-level biological requirements can be met considering the significance of the effects of the action under consultation. Recovery planning can provide the best guidance for making this determination. The 1995 FCRPS Biological Opinion stated:

> Recovery plans for listed salmon call for measures in each life stage that are based upon the best available scientific information concerning the listed species' biological requirements for survival and recovery. As the statutory goal of the recovery plan is for the species' conservation and survival it necessarily must add these life-stage specific measures together to result in the survival of the species, at least, and its recovery and delisting at most. For this reason, the Recovery Plan

> is the best source for measures and requirements necessary in each life stage to meet the biological requirements of the species across its life cycle (p. 14).

Recovery planning will identify the feasible measures that are needed in each stage of the salmonid life cycle for conservation and survival within a reasonable time. Measures are feasible if they are expected both to be implemented and to result in the required biological benefit. A time period for recovery is reasonable depending on the time requirements for implementation of the measures and the confidence in the survival of the species while the plan is implemented. The plan must demonstrate the feasibility of its measures, the reasonableness of its time requirements, and how the elements are likely to achieve the conservation and survival of the listed species based on the best science available.

In 1995, NMFS relied upon the Proposed Snake River Salmon Recovery Plan, issued in draft in March 1995. Since 1995, the number of listed salmonid species has gone from three to 12, and the need for recovery planning for Columbia basin salmonids has quadrupled. Rather than finalize the 1995 proposal recovery plan, NMFS has developed guidelines for basin-level, multi-species recovery planning upon which individual, species-specific recovery plans can be founded. This foundational recovery planning analysis is contained in the document entitled "Conservation of Columbia Basin Fish: A Conceptual Recovery Plan" (hereafter, the "All-H Paper" [NMFS 2000]). This All-H Paper replaces the 1995 proposal recovery plan for Snake River stocks until a plan specific to those stocks is developed based on the All-H Paper. Recovery plans for each individually listed species will provide the particular statutorily required elements of recovery goals, criteria, management actions, and time estimates that are not developed in the All-H Paper.

Until the species-specific recovery plans are developed, the All-H Paper provides the best guidance for judging the significance of an individual action relative to the species-level biological requirements. In the absence of full recovery planning, NMFS strives to ascribe the appropriate significance to actions to the extent available information allows. Where information is not available, NMFS applies a conservative substitute that is likely to exceed what would be expected of an action if full recovery planning were available. To avoid jeopardy and adverse modification of critical habitat where there is no recovery plan – either because one has yet to be developed, or the species status is so dire that no feasible plan can be determined – the action must avoid adverse effects on listed individuals and their habitat to the greatest extent reasonably prudent, then provide offsetting mitigation for adverse effects that cannot be avoided.

In the absence of a recovery plan, the uncertainty of whether an action avoids jeopardy or adverse modification of critical habitat is greater. Therefore, an action must avoid or offset adverse effects to the listed species to a greater extent than could likely be determined with the benefit of recovery planning. This extra effort is necessary to meet the statutory requirement that an Action Agency "ensure," in the face of uncertainty, that its action is not likely to jeopardize the species or adversely modify critical habitat.

1.3.1 Section 7(a)(2) Jeopardy Analysis Framework Applied to FCRPS

1.3.1.1 Jeopardy Standard

The mortality of listed salmonids within the different ESUs that is attributable to the action must be below the following:

- A level that, when combined with mortality occurring in other life stages, results in a high likelihood of survival and a moderate to high likelihood of recovery

or, in the absence of a recovery plan, or similar analysis,

- A level equal to and no higher than that which would occur in the absence of the action (i.e., full mitigation).

In the application of this standard, NMFS relies on all of the best available scientific information. For some ESUs this involves a great deal of modeling analysis, including simple determinative models of passage survival, the CRI analysis of population status, and the incorporation of both into matrix analyses to assess the effects of alternative operations on survival from one generation to the next. For the purposes of this analysis, NMFS determined that there was sufficient information to do these analyses for five of the 12 ESUs. Even for these ESUs, however, there is still substantial uncertainty in the resulting projections of the likelihood of survival and recovery. As a result, NMFS relies on this analysis primarily to provide a standardized measure of risk against which to judge the significance of the action to the continued existence of the ESU. In the end, however, NMFS' determination of consistency with ESA Section 7(a)(2) is qualitative, informed to the extent possible by standardized quantitative analysis.

1.3.1.2 Metrics Useful for Assessing Jeopardy Standards from the FCRPS

As noted above, NMFS has determined for the purposes of this Biological Opinion that there is sufficient information available to conduct quantitative analyses to estimate offsite mitigation goals for five of the 12 ESUs. They are SR spring/summer chinook, SR fall chinook, UCR spring-run chinook, UCR steelhead, and SR steelhead. This section describes a number of metrics integral to that analysis.

1.3.1.2.1 Metrics Indicative of Survival. For the survival component of the jeopardy standard, a metric representing the probability of absolute extinction (no more than one fish returning over the number of years in a generation) within 100 years (McClure et al. 2000) is relevant. A standardized metric of 5% probability of absolute extinction is reviewed in assessing whether the species has a high likelihood of survival under the proposed action. A 100-year period captures both short- and long-term risk because a population that has a certain probability of extinction within a short time such as 24 years will have at least that probability of extinction in 100 years. A 24-year period is also reviewed because the range of uncertainty around the 100-year metric is quite large and because there is potential to further modify the action in the near term through

the adaptive management process if monitoring and evaluation indicate a need for further action to avoid the longer-term risks. Absolute extinction is used instead of a quasi-extinction level because of the unambiguous interpretation of this metric, whereas quasi-extinction levels such as 20, 50, or 100 fish have different meanings for populations of different sizes and capacities in different river systems. An extinction threshold of one fish is the only extinction threshold that has the same biological meaning regardless of which index stock or population is addressed.

This extinction metric is used in preference to the survival threshold metric that was used in the 1995 FCRPS Biological Opinion. A review by the Independent Scientific Advisory Board (ISAB 1999) considered the survival threshold metric "… insufficiently linked to the ESA considerations of probability of extinction. . . ." The survival threshold approach was also criticized by a review panel (Barnthouse et al. 1994), that stated that, if the threshold represents a critical level, "it makes little sense to define persistence in terms of the frequency of years in which the populations are below the critical level. Presumably, even one such year is undesirable." If, on the other hand, the threshold represents some less critical level, the review panel described that level as necessarily arbitrary. The panel also noted difficulties in interpretation of the particular thresholds that were eventually used in the 1995 FCRPS Biological Opinion relative to historical performance of those stocks. Botsford (1997) also noted shortcomings of the survival threshold metric.

1.3.1.2.2 Metrics Indicative of Recovery. The recovery metric stated in NMFS' 1995 Biological Opinion is a relevant indicator of the recovery component of the jeopardy standard. This recovery metric is the likelihood that the 8-year geometric mean abundance of natural spawners in a population will be equal to or greater than an identified recovery abundance level. Recovery abundance levels have not been finally determined for any ESUs; however, the best available estimates of recovery abundance levels for five ESUs and certain component populations or index areas are described in Table 1.3-1. For ESUs for which the recovery abundance levels have not been proposed, NMFS will rely on the survival performance standard until recovery levels are determined. This is reasonable because the available guidance for setting recovery goals emphasizes the survival of component populations of ESUs over 100 years (McElheny et al. 2000):

> "A viable salmonid population is an independent population of any Pacific salmonid (genus Oncorhynchus) *that has a negligible risk of extinction* due to threats from demographic variation (random or directional), local environmental variation (random or directional) *over a 100-year time frame* [italics added]."

Although other criteria suggested in McElhany et al. (2000) will also be considered when setting recovery abundance levels, these cannot be evaluated at present. However, by specifying that the survival component of the jeopardy standard must be met, the most significant factor used to develop recovery criteria will also be met.

Ultimately, recovery goals for each ESU will be established using the criteria outlined in the Viable Salmonid Paper. Until technical recovery teams formally apply VSP standards to determine recovery goals for all ESUs, we rely on the following:

- Goals established during the quantitative analysis (QAR) process for the UCR ESUs
- Abundance goals established in the 1995 recovery plan for the SR spring/summer chinook and fall chinook salmon ESUs

Recovery time periods for each ESU must also be determined by recovery planning. The 1995 FCRPS Biological Opinion evaluated the likelihood of recovery within 48 years. It may be unrealistic to expect populations to return to recovery abundance levels within this time period. Both the 48-year and the 100-year probabilities are reviewed in assessing whether the species has a moderate to high likelihood of recovery under the proposed action.

1.3.1.2.3 Metric Indicative of Full Mitigation. If an ESU-level analysis is not possible to determine the combination of actions affecting all life stages of a species necessary to result in a high likelihood of survival and a moderate to high likelihood of recovery, the FCRPS must reduce mortality to a level equal to, and no higher than, that which would occur in the absence of the action. NMFS finds that currently available information and analysis cannot distinguish between the mortality attributable to the action under consultation and that attributable to the existence of the FCRPS projects. Therefore, one method of ensuring that the Section 7(a)(2) standards are met is to require the FCRPS to reduce mortality of listed species to no more than the level of mortality that would occur if the hydrosystem was not in place, unless and until a lesser level is identified through recovery planning.

A committee of biologists from Federal agencies involved in this consultation attempted to estimate natural survival through that reach of the river which is currently impounded by the hydrosystem to aid in evaluating the full mitigation component of the performance standard. A variety of methods was evaluated, and those NMFS considered to represent application of the best available scientific information to this question were used to generate the estimates in Table 1.3-2. Details regarding this approach are described in Appendix C.

Table 1.3-1. Interim Proposed Recovery Levels for Some Columbia River ESUs

ESU/Population/Stock	Recovery Abundance Level	Notes:
SR Spr/sum chinook (at Ice Harbor)	31,440	Source: NMFS (1995a)
SR Spr/Sum Chinook Index Stocks:		
Bear Valley/Elk Creeks	911	Recovery goals for Snake River index stocks defined as 60% of pre-1971 abundance (Source: NMFS 1995a) [1]
Minam River	439	
Imnaha River	802	
Poverty Flats	866	
Johnson Creek	288	
Marsh Creek	426	
Sulphur Creek	283	
SR fall chinook (aggregate pop.)	2,500	Source: NMFS (1995a)
SR sockeye[2]	2,000	Source: NMFS (1995a)
UCR Steelhead Populations:		
Wenatchee River	2,500	Source: draft report on population structure and biological requirements of UCR steelhead and spring chinook salmon (Ford et al. 1999)
Methow River	2,500	
Entiat River	500	
UCR Spring Chinook Populations:		
Wenatchee River	3,750	Source: Ford et al. (1999)
Methow River	2,000	
Entiat River	500	

Note: Recovery abundance levels refer to naturally spawning adults

[1] Pre-1971 abundance for index stocks from Excel spreadsheet titled \svr99_1_12_2000.xls, (received from E. Tinus, ODFW, on January 12, 2000)

[2] SR sockeye salmon in Redfish Lake and two other lakes in the Snake River basin

Table 1.3-2. Summary of Estimates of Life-Stage-Specific FCRPS Hydrosystem Survival for Assessing Full Mitigation Performance Standard

ESU	Life Stage					Total Hydro Survival (Juvenile + Adults)
	Spawning to Smolt	Smolt Survival from Upper to Lower Dam	1 - Delayed Mortality of Smolts Below Lower Dam	Adult Survival from Lower to Upper Dam	1 - Delayed Mortality of Adults Above Upper Dam	
Chinook Salmon:						
SR s/s chinook	N/A	0.82	1.0	0.85	1.0	0.70
SR fall chinook	Q	0.32 (Meth A) 0.77 (Meth B)	1.0	0.72	1.0	0.23 - 0.55
UCR spr chinook	N/A	0.90	1.0	0.92	1.0	0.83
LCR chinook	Q	0.99	1.0	0.98	1.0	0.97
UWR chinook	N/A	N/A	1.0	N/A	N/A	1.0
Steelhead:						
SR steelhead	N/A	0.84	1.0	0.85	1.0	0.71
UCR steelhead	N/A	0.91	1.0	0.92	1.0	0.84
MCR steelhead	N/A	0.91	1.0	0.92	1.0	0.84
UWR steelhead	N/A	N/A	1.0	N/A	N/A	1.0
LCR steelhead	N/A	0.99	1.0	0.98	1.0	0.97
SR Sockeye	N/A	??	1.0	0.85	1.0	??
CR Chum	Q	??	1.0	0.85	1.0	??

Notes: Unless otherwise noted, estimates are multi-year means
Estimation methods and data sets are described in Appendix C.
N/A = not applicable to the ESU; ?? = information not available; Q = qualitative discussion in narrative